Kontron User's Guide

MOPSlcdLX

Document Revision 2.1

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1. User Information

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1.6 Technical Support

Technicians and engineers from Kontron Embedded Modules GmbH and/or its subsidiaries are available for technical support. We are committed to making our product easy to use and will help you use our products in your systems.

Before contacting Kontron Embedded Modules GmbH technical support, please consult our Web site at http://www.kontron-emea.com/emd for the latest product documentation, utilities, and drivers. If the information does not help solve the problem, contact us by telephone or email.

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2. Introduction

2.1 MOPSlcdLX

MOPSlcdLX SBC modules support the AMD LX800 Embedded System Platform. The MOPSlcdLX is a versatile, low-cost, low-power module that conforms to the industry standard 90mm x 96mm PC/104 form factor. The board's chipset includes a AMD Geode LX800 CPU with an integrated graphics controller and the Companion Chip CS5536.

For visualization tasks, the graphics controller features up to 254 MB of Shared Memory Architecture (SMA) and a JUMPtec Intelligent LVDS Interface (JILI) for trouble-free adaptation to all common LCD panels. Standard CRT output is also available.

The MOPSlcdLX features the following:

- AMD LX800 CPU
- System ROM (BIOS)
- Up to 1 GB DDR-SDRAM support
- Direct memory access (DMA) controllers
- Counters
- Interrupt controllers
- Keyboard/mouse controllers
- Speaker interface
- Floppy-drive interface
- Integrated Drive Electronics (IDE) hard-disk interface
- Serial ports (COM1 and COM2)
- Parallel port (LPT1)
- Real-time clock
- Watchdog timer
- Universal serial bus (USB) ports
- 10/100Base-TX Ethernet
- ISA bus
- PCI bus

2.2 MOPS Family

MOPS (**M**inimized **O**pen **P**C **S**ystem) PC/104 products represent the “Proven PC Platform for Instant Solutions." Each MOPS module is characterized by the same pinout for the keyboard, COM1 and COM2, 44-pin IDE, LPT, and 1st LAN. These homogeneous features facilitate easy upgrades within the Kontron Embedded Modules GmbH MOPS PC/104 product family.

Whenever a LCD panel is required, MOPS products with onboard graphics controllers serve as the right choice. Display connections are simplified when using these units, which come with a JUMPtec Intelligent LVDS Interface (JILI) interface. The interface can recognize which display is connected and then independently set all video parameters. This interface is not available on all MOPS products. All MOPS PC/104 are plug-and-work enabled to further reduce time-to-market.

As part of the standard features package, all MOPS PC/104 modules come with a JUMPtec Intelligent Device Architecture (JIDA) interface, which is integrated into the BIOS of the PC/104 modules. This interface enables hardware independent access to the MOPS PC/104 features that cannot be accessed via standard APIs. Functions such as watchdog timer, brightness of LCD backlight and user bytes in the EEPROM can be configured with ease by taking advantage of this standard MOPS PC/104 module feature.

All MOPS PC/104 products can be controlled remotely by using JRC software through a serial port. The software allows you to change, update, and maintain the MOPS products from a host computer via a serial connection.

2.3 PC/104 an Embedded PC Standard

By standardizing hardware and software around the broadly supported PC architecture, embedded system designers can substantially reduce development costs, risks, and time-to-market.

For these reasons, companies that embed microcomputers as controllers within their products seek ways to reap the benefits of using the PC architecture. However, the standard form factor of a PC bus (12.4" x 4.8") and its associated card cages and backplanes are too bulky and expensive for most embedded control applications.

The only practical way to embed the PC architecture in space and power sensitive applications has been to design a PC chip by chip directly into the product. But this runs counter to growing trend away from "reinventing the wheel." Whenever possible, management encourages outsourcing of components and technologies to reduce development costs and accelerate product design cycles.

A need has arisen for a more compact implementation of the PC bus, satisfying the reduced space and power constraints of embedded control applications. PC/104 was developed in response to this need. It offers full architecture, hardware and software compatibility with the PC bus but in ultra-compact (3.6" x 3.8") stackable modules. PC/104 is ideally suited to the unique requirements of embedded control applications.

Although configuration and application possibilities with PC/104 modules are practically limitless, there are two ways to use them in embedded system designs:

- **Standalone module stacks**
  PC/104 modules are self-stacking. The modules are used like ultra-compact bus boards but do not need backplanes or card cages.
- **Component line applications**
  In this configuration, the modules function as highly integrated components, plugged into custom carrier boards that contain application specific interfaces and logic.

3. Getting Started

The easiest way to get the MOPSlcdLX board running is to use a starter kit from Kontron Embedded Modules GmbH. Take the following steps:

❶ Connect the power supply to the starter kit baseboard (part of the starter kit).

❷ Plug a suitable DDR-SDRAM memory module into the RAM socket of the MOPSlcdLX.

❸ Plug the MOPSlcdLX to the PC/104 bus connector on the starter kit baseboard.

❹ Make all necessary connections from the MOPSlcdLX to the starter kit board. (cables come with the starter kit). The starter kit board offers various interfaces on standard connectors.

❺ Connect the CRT monitor to the CRT interface or a LCD panel to the JILI interface by using the corresponding adapter cable.

❻ Plug a keyboard to the starter kit's keyboard connector.

❼ Connect the floppy drive (part of the starter kit) with the data cable (part of the starter kit) to the MOPSlcdLX floppy interface and connect the power supply to the floppy's power connector.

❽ Plug a hard-drive data cable to the MOPSlcdLX hard-disk interface. Attach the hard disk to the connector at the opposite end of the cable. If necessary, connect the power supply to the hard disk's power connector.

❾ Make sure all your connections have been made correctly. Turn on the power.

❿ Enter the BIOS by pressing the Del key during boot-up. Make all changes in the BIOS Setup. See the BIOS chapter of this manual for details.

4. Specifications

4.1 Functional Specifications

➤ **Processor**

- AMD Geode LX800 Embedded Processor

➤ **Internal Bus**

- 33 MHz PCI bus
- Up to 333 MHz memory bus

➤ **Chipset**

- AMD Companion Chip CS5536

➤ **Power Supply**

- 5V supply
- Onboard power supply to low-voltage technology

➤ **Super I/O**

- Winbond W83627

➤ **Cache**

- On-die second level 128 kB

➤ **Memory**

- One 200-pin SODIMM interface run with DDR266 to DDR400 2.5/2.6V PC2100 or PC3200 unbuffered DDR-SDRAM, up to 1GB

➤ **Two Serial Ports**

- COM1 and COM2 (RS232C compatible)

➤ **One Parallel Port (LPT1)**

- Enhanced Parallel Port (EPP) with bidirectional capability

➤ **Floppy Interface**

➤ **EIDE-Interface (P-ATA)**

- UDMA Peripheral Component Interconnect (PCI) Bus Master IDE ports (up to two devices)

➤ **Universal Serial Bus (USB)**

- Two USB 2.0 ports (OHCI/EHCI)
- USB legacy keyboard support
- USB floppy boot support

Ethernet

- Intel 82551ER 10/100 Mbps PCI Fast Ethernet controller

Onboard Video Graphics Array (VGA)

- Integrated in AMD LX800 (Processor)
- Up to 254 MB Video RAM (SMA)
- Cathode ray tube (CRT) and low voltage differential signaling (LVDS) LCD flatpanel interfaces

Award BIOS, 512 kB Flash BIOS

NV-EEPROM for CMOS Setup Retention without Battery

PS/2 Keyboard Controller

PS/2 Mouse Controller

Watchdog timer (WDT)

Real-time Clock (requires external battery)

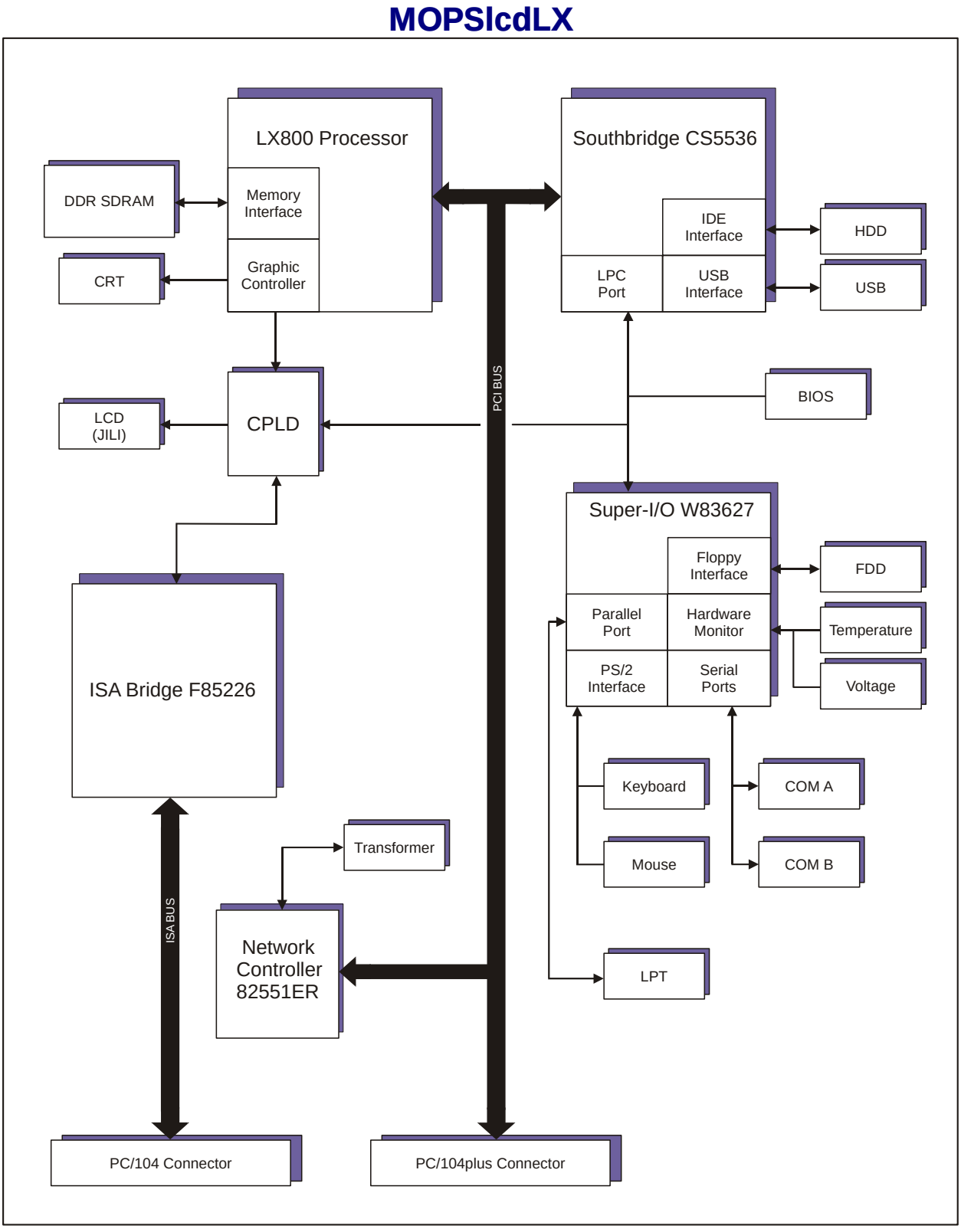
External ISA Bus

- Full 8/16 bit Memory and I/O access
- All ISA IRQ and 8 bit DMA signals
- Only 8 bit DMA available
- ISA bus master mode not supported

External PCI Bus

- 33 MHz PCI clock
- Only 3.3V PCI cards supported
- Onboard 3.3V V_{IO} switchable by resistor

4.1.1 Block Diagram



4.2 Mechanical Specifications

4.2.1 PC/104 Bus Connector (ISA part)

- One 2x32 pin stackthrough and one 2x20 pin stackthrough connector

4.2.2 PC/104+ Bus Connector (PCI part)

- One 4x30 pin stackthrough connector

4.2.3 Module Dimensions

- 96 x 90 mm (3.77” x 3.55”)

4.2.4 Weight

- 98 g (full feature version without memory module)

4.3 Electrical Specifications

4.3.1 Supply Voltage

- 5V DC +/- 5 %

4.3.2 Supply Voltage Ripple

- 100 mV peak to peak 0 - 20 MHz

4.3.3 Supply Current (typical)

Power consumption tests were executed during the DOS prompt. The tested boards were equipped with 256 MB SDRAM / 32 MB chipDISK.

CPU	AMD LX800 (500 MHz)		
Mode	Normal	Standby	Suspend
Power Consumption	1.5A	t.b.d.	t.b.d.

4.3.4 Supply Current (maximum)

CPU	AMD LX800 (500 MHz)
Power Consumption	t.b.d.

(calculated theoretical values from all components maximum supply currents)

4.3.5 External RTC Battery

- Voltage range: 2.4 V - 3.6 V (typ. 3.0 V)
- Maximum current: 10 µA

4.4 Environmental Specifications

4.4.1 Temperature

➤ Operating (with appropriate airflow):

- Maximum operating temperature: 0 to +60 °C *(1)*

➤ Non operating: -10 to +85 °C

Note: *1 The maximum operating temperature is the maximum measurable temperature on any spot on a module's surface. You must maintain the temperature according to the above specification.*

4.4.2 Humidity

➤ Operating: 10% to 90% (non condensing)

➤ Non operating: 5% to 95% (non condensing)

4.5 MTBF

The following MTBF (Mean Time Between Failure) values were calculated using a combination of manufacturer's test data, if the data was available, and a Bellcore calculation for the remaining parts. The Bellcore calculation used is "Method 1 Case 1". In that particular method the components are assumed to be operating at a 50 % stress level in a 40° C ambient environment and the system is assumed to have not been burned in. Manufacturer's data has been used wherever possible. The manufacturer's data, when used, is specified at 50° C, so in that sense the following results are slightly conservative. The MTBF values shown below are for a 40° C in an office or telecommunications environment. Higher temperatures and other environmental stresses (extreme altitude, vibration, salt water exposure, etc.) lower MTBF values.

➤ System MTBF (hours) : tbd

Note: *Fans usually shipped with Kontron Embedded Modules GmbH products have 50,000-hour typical operating life. The above estimates assume no fan, but a passive heat sinking arrangement. Estimated RTC battery life (as opposed to battery failures) is not accounted for in the above figures and need to be considered for separately. Battery life depends on both temperature and operating conditions. When the Kontron unit has external power; the only battery drain is from leakage paths.*

5. CPU, Chipset and Super I/O

5.1 CPU

The central processing unit (CPU) is part of the AMD Geode LX Embedded processor with following features:

- Extremly low power dissipation
- MMX and 3Dnow! instruction set
- Two 64 kB on-chip level 1 caches
- 128 kB on-chip level 2 cache

5.2 Chipset

The AMD LX chipset consists of:

- LX800 Embedded Processor (Northbridge)
  - Advanced high-performance 64 bit DDR SDRAM controller
  - Supports standard DDR200 to DDR400 memory types up to 1GB
  - High performance 2D graphics controller
  - Supports up to 1600x1200x32 bpp at 60 Hz for TFT interface
  - Hardware VGA
  - PCI 2.2 compliant bus controller
  - 32bit 3.3V PCI interface
  - Advanced system power management support
  - Security block with 128 bit AES hardware support
- CS5536 Companion Chip (Southbridge)
  - 32bit 3.3V PCI interface
  - Four integrated USB controller (OHCI/EHCI)
  - Integrated Enhanced-IDE controller
  - Integrated LPC port controller
  - System Management (SM) bus interface
  - Advanced system power management support
  - Legacy device support (Timer, IRQ and DMA controller)
  - Internal Real-Time clock with CMOS RAM

5.3 Super I/O

The external Super I/O WINBOND W83627 offers the following features:

- Integrated keyboard controller with PS/2 mouse support
- Two serial ports and one multi-mode parallel port
- Floppy disk controller

6. System Memory

The MOPSlcdLX uses only 200-pin Small Outline-Dual Inline Memory Modules (SODIMMs). One socket is available for 2.5/2.6 Volt (power level) unbuffered PC-2100 (DDR200) up to PC-3200 (DDR400) Double Data Rate Synchronous Dynamic Random Access Memory (DDR-SDRAM) of up to 1 GB.

Attention: DDR400 modules can only be operated with DDR333.

Two additional entries in the Setup of the System BIOS ('Mem Controller Buffering' and 'Mem Controller Line Delay') are improved stability of the board while using DDR333 RAM modules. A 'Line Delay' of 2 is the best setting for most modules.

The total amount of memory available on the SDRAM module is used for main memory and graphic memory on the MOPSlcdLX. Shared Memory Architecture (SMA) manages the sharing of the system memory between graphic controller and processor. Therefore, the full memory size is not available for software applications. Up to 254 MB of system memory are used as graphic memory.

To find the location of the SDRAM socket J8000 on the MOPSlcdLX board, please see the Appendix "Connector Layout".

7. ISA Bus Expansion

The design of the MOPSlcdLX follows the standard PC/104 form factor and offers ISA bus signals for the use of standard PC/104 adapter cards.

7.1 PC/104 Bus (ISA part)

The PC/104 bus consists of two connectors that use 104 pins in total.

- XT bus connector (64 pins)
- AT bus connector (40 pins, which is optional for 16 bit data bus system)

The pinout of the PC/104 bus connectors corresponds to the pinout of the ISA bus connectors with some added ground pins. The two PC systems with different form factors are electrically compatible.

The **XT bus connector**, Row A and B.

The corresponding 64-pin stackthrough header (ISA bus = 62pins) has two added ground pins at the end of the connector (Pin A32 and Pin B32). The pinout between PC/104 bus and XT ISA bus is identical between A1 - A31 and B1 - B31.

The **AT bus extension connector**, Row C and D.

The corresponding 40-pin stackthrough header (ISA bus = 36 pins) has four added ground pins, two on each side of the connector. To avoid confusion, the first two pins are defined as Pin C0 and Pin D0. The additional ground pins at the end of the connector are defined as C19 and D19. The pinout between PC/104 bus and AT ISA bus is identical between C1 - C18 and D1 - D18.

7.1.1 PC/104 Connectors

The MOPSlcdLX features both – XT bus and AT bus extension – on two, dual-row socket connector with 2.54mm x 2.54mm grid (0.1" x 0.1").

The PC/104 XT bus is available through the X10000A connector. The PC/104 AT bus is available through the X10000B connector.

A detailed description of the signals including electrical characteristics and timings is beyond the scope of this document. Please refer to the official ISA bus and PC/104 specifications for more details.

7.1.2 PC/104 Configuration

When using add-on boards on the PC/104 bus, make sure that there are no resource conflicts in the system. Carefully choose hardware interrupts, DMA channels, memory and I/O address ranges to avoid resource conflicts, which are often the reason for a board or a feature not functioning correctly.

PC/104 adapter cards are mounted in a stack-through manner. Adapter cards are designed with plugs on their undersides that mate with the PC/104 socket connectors of MOPSlcdLX. PC/104 adapters can support the socket connector version on their topside and allow additional stacking of adapters.

Whenever possible use the MOPSlcdLX as top module of the PC/104 stack as the CPU board is normally the board with the highest heat dissipation.

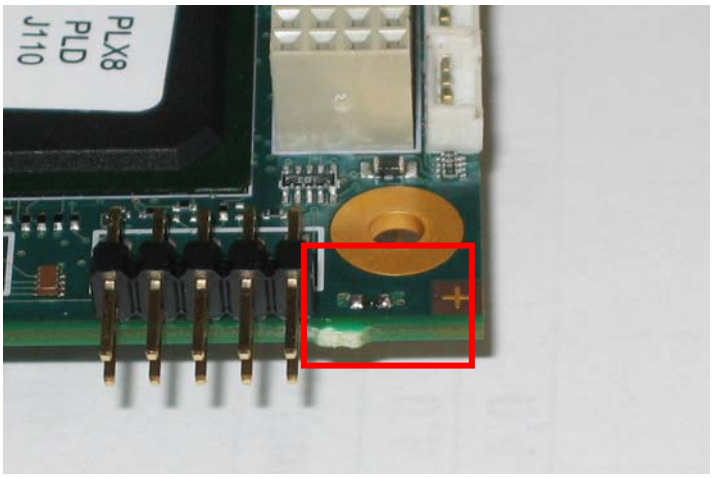
8. PCI BUS Expansion

The MOPSlcdLX is available in different versions with or without PC/104+ bus. On boards with this option a quad-row socket stack-through connector with a 2mm x 2mm (0.79" x 0.79") pitch that implements the standard 32-bit PCI bus signals is available.

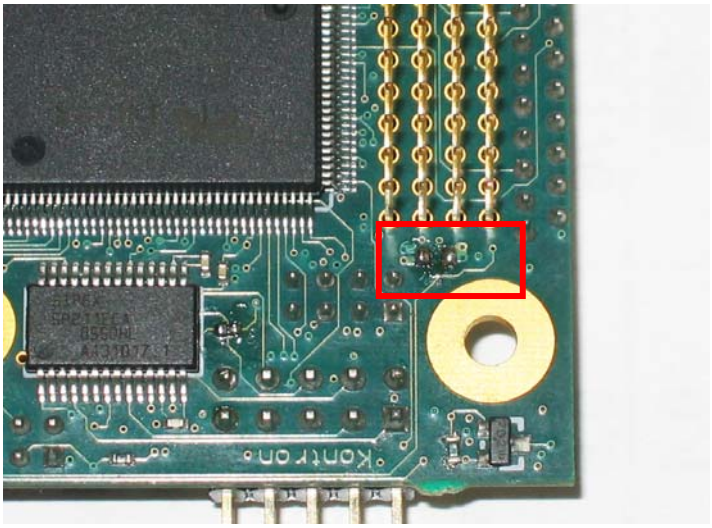
8.1 Configuration of $V_{I/O}$ and VCC

The PCI Bus of the MOPSlcdLX is 3.3V only. The default settings for $V_{I/O}$ and VCC are not connected. If it is ensured that the PCI expansion cards are types of 3.3V only, Zero-Ohm bridges can be set (see picture 1 and picture 2). 5V PCI expansion cards can damage the board.

Top Side (Picture 1)



Bottom Side (Picture 2)

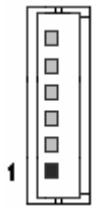


9. Graphics Interface

The onboard graphics controller supports CRT monitors and a variety of LCD panels with single or dual clock, color depths of 18/24 bit and resolutions up to UXGA (1600x1200).

9.1 CRT Connector

The CRT monitor interface is available through the X12001 connector (6 pins). To have the signals available on a standard DSUB-15 CRT monitor connector, an adapter cable is required. A 15-pin DSUB cable is available from Kontron (KAB-VGA-2, Part Number 96053-0000-00-0).

Header	Pin	Signal Name	Function	DSUB-15
	1	RED	Analog video red	1
	2	GREEN	Analog video green	2
	3	BLUE	Analog video blue	3
	4	GND	Signal ground	7
	5	VSYNC	Vertical sync	14
	6	HSYNC	Horizontal sync	13

To find the location of the CRT connector on the MOPSlcdLX board, please see the Appendix "Connector Layout".

9.2 LCD Panel Connector

The interface for the LCD Panel is available through the X12000 connector (40 pins) on the top side of the board. This connector represents the JILI interface (**J**UMPtec **I**ntelligent **L**VDS **I**nterface). The implementation of this subsystem complies with the JILI Specification of Kontron Embedded Modules GmbH. A variety of cables for different display types are available from Kontron. Please refer to the actual cable list on the Kontron Web site for part numbers and cable names. A detailed description of the JILI interface standard also is available in a separate document JILI-M???.PDF. The three question marks represent the documents revision number. You can download this document from the Kontron Web site, or contact your local Kontron technical support to receive it.

To find the location of the LCD Panel interface connector on the MOPSlcdLX board, please see the Appendix "Connector Layout".

9.3 Display Power Considerations

When using a LCD Panel, additional voltages may be required to drive the displays logic and supply the backlight converter. The display logic may require +5V or +3.3V Backlight converters usually are +5V or +12V types. When using a Kontron JILI cable, you do not need to determine such configurations. Display logic voltage come preconfigured on the JILI cable. On occasion, backlight voltage has to be adjusted on the cable.

Even though the MOPSlcdLX is a +5V only board, you need to supply the +12V for the backlight converter additionally when using such a converter type. The onboard +3.3V circuitry and the +3.3V logic voltage of low-voltage panels are powered by separate voltage regulators.

9.4 Connecting a LCD Panel

To determine whether your panel display is supported, check the Kontron Web site for panel lists. We regularly update the list of panels that have been tested with the MOPSlcdLX.

If you use one of those adapters supplied by Kontron, configuration is easy:

❶ Check whether you have the correct adapter and cable for the panel you plan to use. Inspect the cable for damages.

❷ Disconnect the power from your system.

❸ Connect the panel adapter to the LCD Panel connector (JILI interface) on the MOPSlcdLX.

❹ Connect the other end of the cable to your display.

❺ Connect the backlight converter.

❻ Supply power to your system.

❼ If no image appears on your display, connect a CRT monitor to the CRT connector.

❽ If necessary program the EEPROM on the JILI cable with the matching configuration data.

❾ If you still do not see improvement, consider contacting the dealer for technical support.

9.5 Available Video Modes

The following list shows the video modes supported by the graphics controller with maximum frame buffer size. When configured for saller frame buffers and/or using a LCD panel on the JILI interface, not all of the video modes listed below may be available. Capability depends on system configuration and on display capabilities. Different operating systems also may not support all listed modes by the available drivers.

9.5.1 Standard IBM-Compatible VGA Modes

Video Mode	Type	Characters/Pixels	Colors
00h/01h	Text	40x25	16
02h/03h	Text	80x25	16
04h/05h	Graphics	320x200	4
06h	Graphics	640x200	2
07h	Text	80x25	Mono
0Dh	Graphics	320x200	16
0Eh	Graphics	640x200	16
0Fh	Graphics	640x350	Mono
10h	Graphics	640x350	16
11h	Graphics	640x480	2
12h	Graphics	640x480	16
13h	Graphics	320x200	256

9.5.2 Extended VESA VGA Modes

VESA Mode	Type	Pixels	Colors
101h	Graphics	640x480	256
103h	Graphics	800x600	256
105h	Graphics	1024x768	256
107h	Graphics	1280x1024	256
110h	Graphics	640x480	32K
111h	Graphics	640x480	64K
112h	Graphics	640x480	16M
113h	Graphics	800x600	32K
114h	Graphics	800x600	64K
115h	Graphics	800x600	16M
116h	Graphics	1024x768	32K
117h	Graphics	1024x768	64K
118h	Graphics	1024x768	16M
119h	Graphics	1280x1024	32K
11Ah	Graphics	1280x1024	64K
11Bh	Graphics	1280x1024	16M
125h	Graphics	1152x864	256
127h	Graphics	1152x864	64K
128h	Graphics	1152x864	16M
131h	Graphics	1600x1200	256
133h	Graphics	1600x1200	64K
134h	Graphics	1600x1200	16M

9.6 Color Modes

There are two interface modes existing at 24-bit color depth: **FPDI** (Flat Panel Display Interface) or **LDI** (LVDS Display Interface). Some panels use the line SELL LVDS (SELect Lvds data order). The LVDS data assignment in the datasheet can give you an indication by the last channel (e.g. RX3/TX3 – SELL LVDS = low) wether it is a **LDI**-panel (contains the lowest bits). Most panels have a **FPDI** interface.

Example:

FPDI data assignment (LVDS channel 3 even or odd):

Tx/Rx27	Red 6 (e.g. even: RE6 or ER6)
Tx/Rx5	Red 7
Tx/Rx10	Green 6 (e.g. even: GE6 or EG6)
Tx/Rx11	Green 7
Tx/Rx16	Blue 6 (e.g. even: BE6 or EB6)
Tx/Rx17	Blue 7
Tx/Rx23	not used

LDI data assignment (LVDS channel 3 even or odd):

Tx/Rx27	Red 0 (e.g. even: RE0 or ER0)
Tx/Rx5	Red 1
Tx/Rx10	Green 0 (e.g. even: GE0 or EG0)
Tx/Rx11	Green 1
Tx/Rx16	Blue 0 (e.g. even: BE0 or EB0)
Tx/Rx17	Blue 1
Tx/Rx23	not used

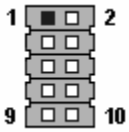
10. Serial-Port Interfaces

Two fully functional serial ports (COMA and COMB) provide asynchronous serial communications. COMA and COMB support RS-232 operation modes. They are 16550 high-speed UART compatible and support 16-byte FIFO buffers for transfer rates from 50 Baud to 115.2 KBaud.

10.1 Connector

COMA is available through the X15000 connector (10 pins) and COMB through the X15001 connector (10 pins). To have the signals available on the standard serial interface connectors DSUB-9 or DSUB-25, an adapter cable is required.

A 9-pin DSUB cable is available from Kontron (KAB-DSUB9-2, Part Number 96017-0000-00-0). The following table shows the pinouts for COMA and COMB, as well as necessary connections for DSUB adapters.

Header	Pin	Signal Name	Function	In/Out	DSUB-25	DSUB-9
	1	/DCD	Data Carrier Detect	In	8	1
	2	/DSR	Data Set Ready	In	6	6
	3	RxD	Receive Data	In	3	2
	4	/RTS	Request to Send	Out	4	7
	5	TxD	Transmit Data	Out	2	3
	6	/CTS	Clear to Send	In	5	8
	7	/DTR	Data Terminal Ready	Out	20	4
	8	/RI	Ring Indicator	In	22	9
	9	GND	Signal Ground	--	7	5
	10	VCC *(1)*	+5V	--	--	--

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

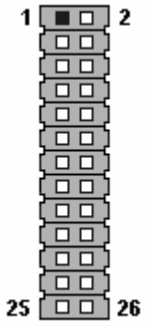
To find the location of the serial ports on the MOPSlcdLX board, please see the Appendix "Connector Layout".

11. Parallel-Port Interface

The MOPSlcdLX incorporates a parallel port that can be set to uni-/bidirectional and supports EPP operating modes.

11.1 Connector

The parallel port is available through the X15004 connector (26 pins). To have the signals available on a standard, parallel interface connector DSUB-25, an adapter cable is required, which is offered by Kontron (KAB-DSUB25-1, Part Number 96015-0000-00-0). The following table shows the pinout as well as necessary connections for a DSUB-25 adapter.

Header	Pin	Signal Name	Function	In / Out	DSUB-25
	1	/STB	Strobe	Out	1
	3	PD0	Data 0	I/O	2
	5	PD1	Data 1	I/O	3
	7	PD2	Data 2	I/O	4
	9	PD3	Data 3	I/O	5
	11	PD4	Data 4	I/O	6
	13	PD5	Data 5	I/O	7
	15	PD6	Data 6	I/O	8
	17	PD7	Data 7	I/O	9
	19	/ACK	Acknowledge	In	10
	21	/BUSY	Busy	In	11
	23	PE	Paper out	In	12
	25	/SLCT	Select out	In	13
	2	/AFD	Autofeed	Out	14
	4	/ERR	Error	In	15
	6	/INIT	Init	Out	16
	8	/SLIN	Select in	Out	17
	26	VCC *(1)*	+ 5V	--	NC
	10,12	GND	Signal Ground	--	18 - 25
	14,16	GND	Signal Ground	--	18 - 25
	18,20	GND	Signal Ground	--	18 - 25
	22,24	GND	Signal Ground	--	18 - 25

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

To find the location of the parallel port on the MOPSlcdLX board, please see the Appendix "Connector Lay-out".

12. Keyboard Interface

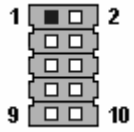
The keyboard and feature connector of the MOPSlcdLX offers four functions. The interface connects the following:

- Keyboard
- Speaker
- Battery
- Reset Button

12.1 Connector

The keyboard and feature connector is available through Connector X15002 (10 pins). An adapter cable is required to connect a standard keyboard to this interface. There are two adapter cables available from Kontron. One can be used for AT-keyboard (KAB-KB-1, Part Number 96023-0000-00-0), the other for PS/2-keyboard (KAB-KB-PS2, Part Number 96060-0000-00-0). The adapter cables do not know the other functions on this interface.

The following table shows the pinout as well as necessary connections for adapters.

Header	Pin	Signal Name	Function	5 pin DIN (Diode)	6 pin MiniDIN (PS/2)
	1	Speaker	Speaker output		
	2	GND	Ground		
	3	/RESIN	Reset input		
	4	/KBLOCK	Keyboard lock		
	5	KBDAT	Keyboard data	2	1
	6	KBCLK	Keyboard clock	1	5
	7	GND	Ground	4	3
	8	VCC *(1)*	+5V	5	4
	9	BATT *(2)*	Battery in (3,0V)		
	10	PWRGOOD	Powergood		

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.
2 Pin 9 and pin 3 (power connector) are not decoupled. Do not connect two batteries.

To find the location of the keyboard and feature connector on the MOPSlcdLX board, please see the Appendix "Connector Layout".

12.2 Signal Descriptions

/RESIN and PWRGOOD (Reset Inputs)

- Input on CPU modules
- When POWERGOOD goes high, it starts the reset generator on the CPU module to pull the onboard reset line high after a valid reset period. You also can use this pin as a low active hardware reset for modules

Speaker

- Open collector output on modules that drive a piezo electronic speaker
- Input on modules that connects a 5V piezo electronic speaker to this pin
- An 8 Ohm loudspeaker also can be connected between SPEAKER and GND, but because of current limitation the volume will be low
- Connect only one speaker to this pin. The CPU usually drives this pin. However, other modules also can use this signal to drive the system speaker

KBDAT (Keyboard Data)

- Bidirectional I/O pin on CPU modules
- Keyboard data signal

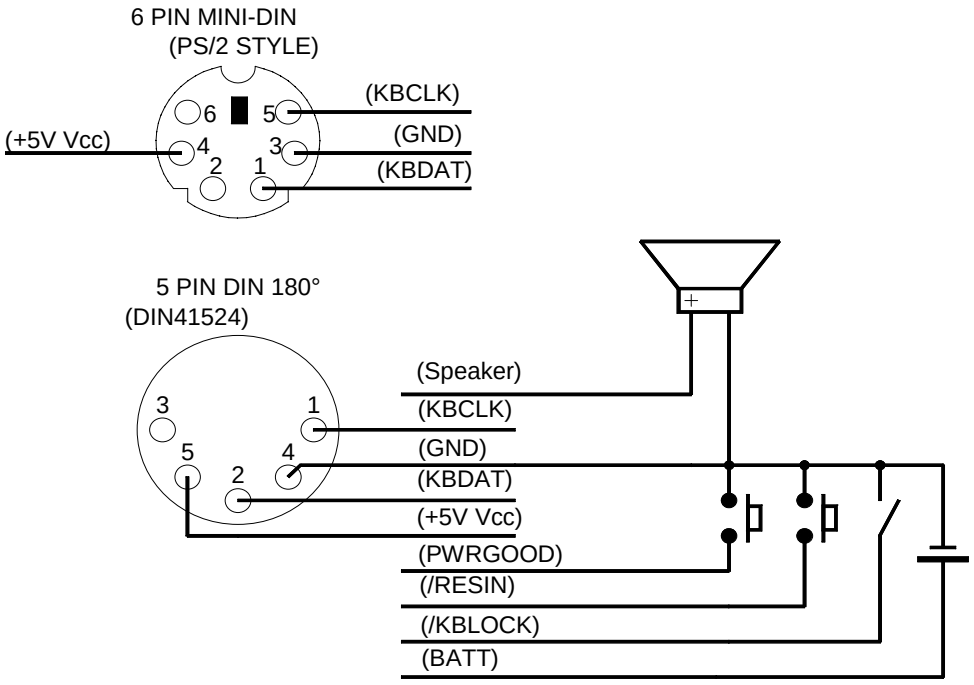
KBCLK (Keyboard Clock)

- Bidirectional I/O pin on CPU modules
- Keyboard clock signal

BATT (System Battery Connection)

- This pin connects a system battery to all modules
- The battery voltage has to be higher than 2.4 V and lower than 3.6 V. A 3 V battery is recommended
- A battery is not needed to hold CMOS setup data. Your configurations for hard disks, floppy drives, and other peripherals are saved in an onboard EEPROM. However, you need a battery to save the CMOS date and time when power supply is turned off

12.2.1 Example Connection AT-keyboard and Other Functions



13. PS/2-Mouse Interface

The Super I/O of the MOPSlcdLX supports a PS/2 mouse.

13.1 Connector

The PS/2 mouse interface is available on Connector X14001 (4pins). An adapter cable is required to connect a standard PS/2 mouse. The cable is available from Kontron (KAB-MOUSE-PS2, Part Number 96062-0000-00-0).

The following table shows the pinout and connections for a PS/2 mouse adapter.

Header	Pin	Signal Name	Function	6 pin MiniDIN PS/2
	1	MSDAT	Mouse data	1
	2	VCC *(1)*	+5V	4
	3	GND	Ground	3
	4	MSCLK	Mouse clock	5

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

To find the location of the PS/2 mouse connector on the MOPSlcdLX board, please see the Appendix "Connector Layout".

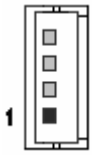
14. USB Interface

The USB interface of the MOPSlcdLX is integrated in the CS5536 companion chip. It comes with two USB ports, which follow the OHCI/EHCI specification and are USB 2.0 compliant. You can expand the amount of USB connections by adding external hubs.

14.1 Connector

The USB ports are available through the X15006 and X15007 connectors (each 4 pins). To have the signals available on the standard USB interface connectors, an adapter cable is required. An USB interface cable is available from Kontron (KAB-USB-1, Part Number 96054-0000-00-0).

The following table shows the pinouts for the USB connectors.

Header	Pin	Signal Name	Function
	1	VCC *(1)*	+5V
	2	USB0	USB-
	3	USB1	USB+
	4	GND	Ground

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

To find the location of the USB ports on the MOPSlcdLX board, please see the Appendix "Connector Layout".

14.2 Limitations

The power contacts for USB devices on Pin 1 and Pin 4 are protected. They are suitable to supply connected USB devices with a maximum of 500 mA power dissipation. Do not supply external USB devices with higher power dissipation through these pins.

15. Floppy-Drive Interface

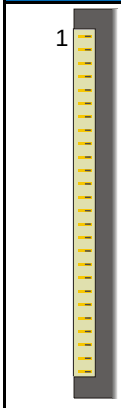
The floppy-drive interface of the MOPSlcdLX uses a 2.88 MB super I/O floppy-disk controller and can support one floppy disk drive with densities that range from 360 kB to 2.88 MB. The controller is 100% IBM compatible.

15.1 Connector

The floppy disk interface is available on the flat-foil connector X15003 (26 pins). This type of connector is often internally used in notebooks to connect a slim-line floppy drive.

Accessories are available for this interface from Kontron. To connect a standard 3.5" floppy drive, use an adapter cable (ADA-FLOPPY-2, Part Number 96001-0000-00-0). If you have a slim-line 3.5" floppy drive, you may need a flat foil cable (KAB-FLOPPY/ MOPS-1, Part Number 96019-0000-00-0). It also is possible to get a slim line 3.5" floppy drive with cable from Kontron (FLOPPY-MOPS-1, Part Number 96010-0000-00-0).

The following table shows the connector pinout.

Header	Pin	Signal Name	Function	Pin	Signal Name	Function
	1	VCC *(1)*	+5V	2	/IDX	Index
	3	VCC *(1)*	+5V	4	/DR0	Drive Select 0
	5	VCC *(1)*	+5V	6	/DSKCHG	Disk Change
	7	NC	Not connected	8	NC	Not connected
	9	NC	Not connected	10	/MTR0	Motor on 0
	11	NC	Not connected	12	/FDIR	Direction Select
	13	NC	Not connected	14	/STEP	Step
	15	GND	Ground	16	/WDATA	Write Data
	17	GND	Ground	18	/WGATE	Write Gate
	19	GND	Ground	20	/TRK0	Track 00
	21	GND	Ground	22	/WRTPRT	Write Protect
	23	GND	Ground	24	/RDATA	Read Data
	25	GND	Ground	26	/HDSEL	Side One Select

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

To find the location of floppy-drive interface on the MOPSlcdLX board, please see the Appendix "Connector Layout".

16. IDE Interface

The MOPSlcdLX features one EIDE interface (Ultra DMA66 mode) that can drive two hard disks. When two devices share a single adapter, they are connected in a master/slave, daisy-chain configuration. If only one drive is in the system, you must set it as the master.

16.1 Connector

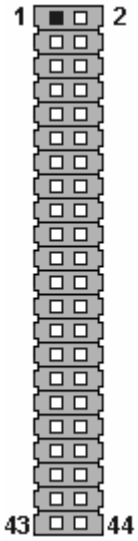
The IDE interface is available through Connector X15005 (44 pins). This interface is designed in 2mm grid for optimal connectivity to a 2.5" hard disk.

There are several accessories available for IDE connectivity.

You can use two cables to directly connect a hard disk in a 2.5" form factor (KAB-IDE-2MM, Part Number 96021-0000-00-0) or a 3.5" form factor (KAB-IDE-25, Part Number 96020-0000-00-0).

You can plug a Kontron chipDISK, which is an IDE hard disk that uses Flash technology, into the IDE interface and mechanically mount it by using a mini-spacer on the chipDISK hole. You also can use a chip-DISK adapter (chipDISK-ADA1, Part Number 96004-0000-00-0) or compact Flash adapter (CFC-ADA1, Part Number 96004-0000-00-2) for more disk support.

The following table shows the pinout.

Header	Pin	Signal Name	Function	Pin	Signal Name	Function
	1	/RESET	Reset	2	GND	Ground
	3	HDD7	Data 7	4	HDD8	Data 8
	5	HDD6	Data 6	6	HDD9	Data 9
	7	HDD5	Data 5	8	HDD10	Data 10
	9	HDD4	Data 4	10	HDD11	Data 11
	11	HDD3	Data 3	12	HDD12	Data 12
	13	HDD2	Data 2	14	HDD13	Data 13
	15	HDD1	Data 1	16	HDD14	Data 14
	17	HDD0	Data 0	18	HDD15	Data 15
	19	GND	Ground	20	Key (NC)	Key pin
	21	DRQ	IDE DMA Request	22	GND	Ground
	23	/IOW	I/O write	24	GND	Ground
	25	/IOR	I/O read	26	GND	Ground
	27	IOCHRDY	I/O channel ready	28	CSEL *(2)*	Cable Select
	29	/ACK	Acknowledge	30	GND	Ground
	31	IRQ	Interrupt	32	NC	Not connected
	33	SA1	Addr 1	34	/PDIAG	Passed Diag
	35	SA0	Addr 0	36	SA2	Addr 2
	37	/CS1	Chip select 1	38	/CS3	Chip select 3
	39	NC	Not connected	40	GND	Ground
	41	VCC *(1)*	+5V	42	VCC Motor *(1)*	+5V
	43	GND	Ground	44	NC	Not connected

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.
2 Pin 28 is connected with 470Ω to Ground for Cable Select IDE devices.

To find the location of IDE interface on the MOPSlcdLX board, please see the Appendix "Connector Layout".

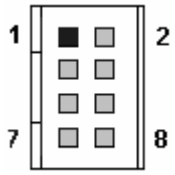
17. Ethernet Controller

The MOPSlcdLX uses a Intel 82551ER PCI Fast Ethernet Controller. The network controllers support 10/100 Base-T interfaces. The devices auto-negotiate the use of a 10 Mbit/sec or 100 Mbit/sec connection. An error-free operation can be guaranteed up to 100 meters CAT4 ethernet cable.

17.1 Connector

The Ethernet interface is available through Connector X16000 (8 pins). To have the signals of the Ethernet connection available on a standard RJ45 connector, you need an adapter cable, which is offered by Kontron (KAB-MOPS-ETN1, Part Number 96048-0000-00-0).

The following table shows the pinout.

Header	Pin	Signal Name	Function	In/Out
	1	TXD+	10BASE-T Transmit	Differential Output
	2	TXD-	10BASE-T Transmit	Differential Output
	3	RXD+	10BASE-T Receive	Differential Input
	4	SHLDGND	Shield ground	
	5	SHLDGND	Shield ground	
	6	RXD-	10BASE-T Receive	Differential Input
	7	SHLDGND	Shield ground	
	8	SHLDGND	Shield ground	

Note: *TXD+, TXD- differential-output pair drives 10 and 100 Mb/s Manchester-encoded data to 100/10 BASE-T transmit lines. RXD+, RXD- differential input pair receives 10 and 100 Mb/s Manchester-encoded data from 100/10BASE-T receive lines.*

To find the location of the Ethernet interface on the MOPSlcdLX board, please see the Appendix "Connector Layout".

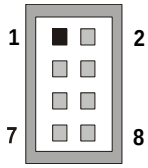
18. Power Connector

In some applications, the MOPSlcdLX is intended for use as a stand-alone module without a backplane. You need to have a power connector available on the board for direct power supply. The MOPSlcdLX is a +5V only board. Peripherals can obtain additional voltage from the power connector next to the PC/104 bus. The additional voltages (+12V, -5V and -12V) are not generated onboard the MOPSlcdLX.

18.1 Connector

The power connector is available as X10000C (8 pins).

The following table shows the pinout.

Header	Pin	Signal Name	Function
	1	GND	Ground
	2	VCC	+5V
	3	BATT	Battery
	4	+12V	+12V
	5	-5V	-5V
	6	-12V	-12V
	7	GND	Ground
	8	VCC	+5V

To find the location of the power connector on the MOPSlcdLX board, please see the Appendix "Connector Layout".

18.2 Power Pins

Every power pin on the power connector as well as on the PC/104 bus connector is limited to a maximum current of 1A per pin.

If a system using a MOPSlcdLX is only supplied from the power connector, the following limitations apply:

Power	Number of Pins	Max. Current
VCC (+5V)	2	2A
+12V	1	1A
-12V	1	1A
-5V	1	1A
GND	2	2A

A system using the MOPSlcdLX also can be supplied from the PC/104 bus connectors. If only those supply voltages pins are used, the following limitations apply:

Power	Number of Pins on ISA Part	Max. Current
VCC (+5V)	4	4A
+12V	2	2A
-12V	2	2A
-5V	2	2A
GND	8	8A

Modules on the PC/104 bus consuming a higher supply current must provide power supply through an additional connector.

Note: *The MOPSlcdLX is not a replacement for a backplane. Use all power pins on the power connector and on the PC/104 connectors for power supply to the MOPSlcdLX, and also use all additional power connectors on additional I/O cards if your system exceeds the above limitations. It is not acceptable to use only the power pins of the PC/104 connector for power supply to the full PC/104 stack.*

18.3 External Battery

You can connect an external battery to Pin 3 (BATT) of the power connector instead of Pin 9 of the KBD connector. For more information refer to the Keyboard chapter of this manual.

Note: *Pin 3 (power connector) and Pin 9 (KBD connector) are connected to the same signal. The pins are not decoupled, therefore do not connect two batteries.*

19. Crisis Management

Modifying parameters in the Setup of the System-BIOS implies the risk of leaving your system in a unbootable state. In case this happens two jumpers exist to reset the settings to the "Fail-Safe Defaults".

In case no battery is connected, then follow these five steps:

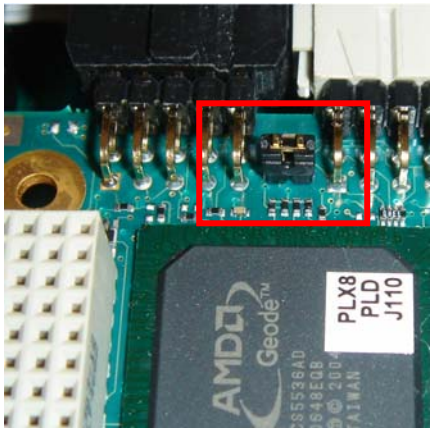
❶ Power down the system

❷ Remove the tagged jumper JP14002 (see the picture)

❸ Power up the system and enter the BIOS Setup

❹ Before saving your new settings with "Save & Exit" put the jumper back

❺ The board should be functional now



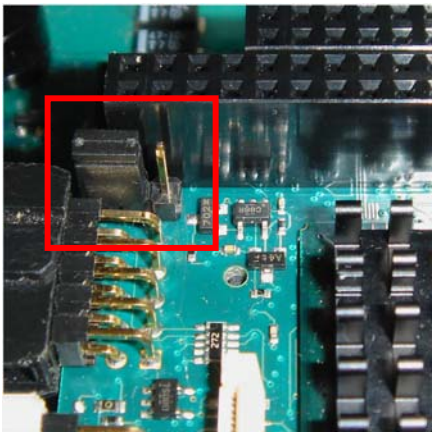
In case there is a backup battery for the real time clock:

❶ power down the system

❷ switch the second jumper JP7000 as depicted, wait for 3 seconds

❸ put the jumper back as it was before

Then continue with the steps from the no battery case.



20. CPU/Memory Speed

Not every combination of CPU and Memory clock frequency is possible. To ensure functionality of the board, please make sure to use only combinations from the following table.

CPU Speed	Memory Speed
200 MHz	DDR200
333 MHz	DDR200
333 MHz	DDR266
333 MHz	DDR333
400 MHz	DDR200
400 MHz	DDR266
400 MHz	DDR333
433 MHz	DDR266
433 MHz	DDR333
500 MHz	DDR266
500 MHz	DDR333

21. Watchdog Timer

The watchdog timer of the MOPSlcdLX can issue a reset to the system. The watchdog timer circuit has to be triggered within a specified time by the application software. If the watchdog is not triggered because proper software execution fails or a hardware malfunction occurs, it will reset the system.

21.1 Programming

21.1.1 Initialization

You can initialize the watchdog timer from the BIOS Setup. You also can set up the initialization from the application software with help of the JIDA (Jumptec Intelligent Device Architecture) programmer's interface.

21.1.2 Trigger

The watchdog needs to be triggered out of the application software within a specified timeout period. You can only do this in the application software by using low-level programming or with help of the JIDA programmer's interface.

For information about the JIDA programmer's interface refer to the JIDA software packages on the Kontron Web site.

22. Special Hardware Hints

22.1 ISA Bus Limitations

The PC/104 ISA bus implementation has the following four restrictions:

- 16 bit DMA cycles (located at DMA5 – DMA7) are not supported
- An ISA device may take control of the bus (ISA bus master mode). This mode is not supported
- Simultaneous usage of Standard Floppy and DMA cycles is not possible
- Using ISA graphic cards, certain high color depth graphic modes may show disturbances i.e. vertical lines. This is due to non-optimum timings in the FINTEK ISA-Bridge, which cannot be fixed.

22.2 PCI Bus Limitations

The PC/104+ PCI bus implementation has the following three restrictions:

- Only 3.3V PCI boards/cards are supported (do not use 5V PCI boards/cards without Level-Shifter)
- Only PCI boards/cards with speed of 33 MHz will be run
- Some problems exists when using the KONTRON ADA9 PC/104+ Evaluation Board (refering to PCI Slots). KONTRON can not guarantee that all PCI cards runs error-free

22.3 Memory Issues

In case you encounter problems during file operations (i.e. copy procedure during Windows installation), these can usually be fixed by decreasing the memory speed. Changing the modul is not necessary, since the modules are working correctly with lower memory speeds.

22.4 Security Block

The standard version of AMD LX800 doesn't contain a EEPROM for storing a hidden key. Please, contact Kontron for further information about the usage of the EEPROM-variation.

23. Onboard Device Configuration

Many of the onboard devices offer several configuration settings in the System BIOS Setup. Refer to chapter SETUP GUIDE for more configuration information.

Onboard Device	see Main menu / Sub menu
Graphics Interface	Advanced Chipset Features / Video Memory Size Advanced Chipset Features / Output Display Advanced Chipset Features / Resolution Advanced Chipset Features / Color Depth Advanced Chipset Features / Pixel per Clock Advanced Chipset Features / Color Mode Advanced Chipset Features / Backlight Value PnP-PCI Configurations / Init Display First
CPU/Memory Interface	Advanced BIOS Features / CPU Internal Cache Advanced BIOS Features / Video BIOS Shadow Advanced BIOS Features / C8000-CBFFF Shadow Advanced BIOS Features / CC000-CFFFF Shadow Advanced BIOS Features / D0000-D3FFF Shadow Advanced BIOS Features / D4000-D7FFF Shadow Advanced BIOS Features / D8000-DBFFF Shadow Advanced BIOS Features / DC000-DFFFF Shadow Advanced BIOS Features / Shadow Read/Write Advanced Chipset Features / CPU Frequency Advanced Chipset Features / Memory Speed Advanced Chipset Features / Mem Controller Buffering Advanced Chipset Features / Mem Controller Line Delay
Serial Port Interfaces	Integrated Peripherals / Onboard Serial Port 1 Integrated Peripherals / Onboard Serial Port 2
Parallel Port Interface	Integrated Peripherals / Onboard Parallel Port Integrated Peripherals / Parallel Port Mode Integrated Peripherals / EPP Mode Select
Keyboard Interface	Advanced BIOS Features / Boot Up Numlock Status Advanced BIOS Features / Gate A20 Option Advanced BIOS Features / Typematic Rate Setting Advanced BIOS Features / Typematic Rate Advanced BIOS Features / Typematic Delay Integrated Peripherals / KBC Input Clock
PS/2 Mouse Interface	Advanced BIOS Features / PS2 Mouse Function
USB Interface	Advanced Chipset Features / USB Controller Advanced BIOS Features / First Boot Device Advanced BIOS Features / Second Boot Device Advanced BIOS Features / Third Boot Device

Network Interface	Advanced Chipset Features / Network Controller Advanced BIOS Features / PXE Lanboot Advanced BIOS Features / First Boot Device Advanced BIOS Features / Second Boot Device Advanced BIOS Features / Third Boot Device
Floppy Drive Interface	Standard CMOS Features / Drive A Advanced BIOS Features / First Boot Device Advanced BIOS Features / Second Boot Device Advanced BIOS Features / Third Boot Device Integrated Peripherals / Onboard FDC Controller
IDE Interface	Standard CMOS Features / IDE Primary Master Standard CMOS Features / IDE Primary Slave Advanced BIOS Features / First Boot Device Advanced BIOS Features / Second Boot Device Advanced BIOS Features / Third Boot Device Integrated Peripherals / Master Drive PIO Mode Integrated Peripherals / Slave Drive PIO Mode Integrated Peripherals / IDE Primary Master UDMA Integrated Peripherals / IDE Primary Slave UDMA Integrated Peripherals / IDE Bus Master Mode Integrated Peripherals / IDE HDD Block Mode
Watchdog Timer	Advanced Chipset Features / Watchdog Mode Advanced Chipset Features / Watchdog Timeout Advanced Chipset Features / Watchdog Delay
Temperature Monitoring	PC Health Status / Shutdown Temperature
BIOS Extensions	Advanced BIOS Features / JRC Extension Advanced BIOS Features / Darkboot - Custom Logo

24. Setup Guide

The AWARD BIOS Setup Utility changes system behavior by modifying the BIOS configuration. The setup program uses a number of menus to make changes and turn features on or off.

The BIOS Setup menus documented in this section represent those found in most models of the MOPSlcdLX. The BIOS Setup for specific models can differ slightly.

24.1 Start AWARD BIOS Setup Utility

To start the AWARD BIOS Setup Utility, press the **<DEL>** key when the following string appears during boot up.

```
Press <DEL> to enter Setup
```

The Main Menu then appears.

24.2 General Information

The **Setup Screen** is composed of several sections:

Setup Screen	Location	Function
Menu Bar	Upper Half	Lists and selects all top-level menus.
Legend Bar	Near Bottom or Bottom	Lists setup navigation keys.
Item Specific Help Window	Bottom or Left Side	Help for selected item.

Menu Bar

The menu bar at the upper half of the window lists different menus. Use the left/right/up/down arrow keys to make a selection.

Legend Bar

Use the keys listed in the legend bar on the bottom to make your selections or exit the current menu.

Note: *In the Option column,* ***bold*** *shows default settings.*

24.3 Main Menu

Feature	Description
Standard CMOS Features	Defines Time, Date, Harddisk and Floppy Type
Advanced BIOS Features	Defines Virus Warning, Cache Availability, Boot Sequence, Keyboard and Mouse Parameters and Shadowing
Advanced Chipset Features	Defines Clocks, Video Settings, USB and Watchdog Features
Integrated Peripherals	Defines IDE Global Settings and Onboard Devices (COM, LPT)
PnP/PCI Configuration	Defines Graphic Boot Device and PCI IRQs
PC Health Status	Shows temperatures and defines shutdown temperature
Load Fail-Safe Defaults	Overwrite Setup Values with Fail-Safe Values
Load Optimized Defaults	Overwrite Setup Values with Optimized Values
Set Supervisor Password	Change, Set or Disable Supervisor Password
Set User Password	Change, Set or Disable User Password
Save & Exit Setup	Saves Setup Values to CMOS and Exit Setup
Exit Without Saving	Discards all Setup Values and Exit Setup

24.4 Standard CMOS Features

Feature	Option	Description
Date	MM/DD/YYYY	Sets system date
Time	HH:MM:SS	Sets system time
▸ IDE Primary Master	Autodetected drive	Displays result of IDE autotyping
▸ IDE Primary Slave	Autodetected drive	Displays result of IDE autotyping
Drive A	None 360 kilobits, 5 ¼ “ 1.2 MB, 5 ¼ “ 720 kilobits, 3 ½ “ **1.44/1.25 MB, 3 ½ “** 2.88 MB, 3 ½ “	Sets type of floppy disk drive
Halt On	All Errors No Errors **All, But Keyboard** All, But Diskette All, But Disk/Key	Determines if errors detected during boot-up cause system to halt.
Base Memory	N/A	Displays amount of conventional memory detected during boot-up
Extended Memory	N/A	Displays amount of extended memory detected during boot-up Extended memory = capacity of memory module – selected frame buffer memory size
Total Memory	N/A	Displays amount of total memory detected during boot-up

24.4.1 IDE Master or Slave Submenus

Feature	Option	Description
IDE HDD Auto-Detection	Press Enter	Executes HDD Auto-Detection
IDE Primary Master/Slave	None **Auto** Manuell	None = disable drive Auto = Auto-Detection, the drive itself supplies the information Manuell = end user supplies the HDD information
Access Mode	CHS LBA Large **Auto**	CHS = physically 28bit addressing mode LBA = adressing mode with logical block numbers Large = for drives that do not support LBA and have more than 1024 cylinders Auto = Auto-Detection, the drive itself supplies the information
Capacity	N/A	Displays the calculated size of the drive
Cylinder	N/A	Number of cylinders
Head	N/A	Number of read/write heads
Precomp	N/A	Write precompensation cylinder number
Landing Zone	N/A	Defines the head park position
Sector	N/A	Number of sectors per track

24.5 Advanced BIOS Features

Feature	Option	Description
Security Option	**Setup** System	Setup = Password required for Setup System = Password required for system boot-up
CPU Internal Cache	Disabled **Enabled**	Enables or disables internal cache
JRC Extension	**Enabled** Disabled	Enables or disables the JRC extension (Remote Control)
Darkboot / Custom Logo	**Disabled** Enabled	If enabled, normally Darkboot will be active. For Custom Logo contact Kontron
Virus Warning	Enabled **Disabled**	Enables or disables the virus warning for IDE hard-disk boot sector
First Boot Device Second Boot Device Third Boot Device	**Floppy (First)** **HDD-0 (Second)** SCSI CDROM HDD-1 USB-FDD USB-ZIP USB-CDROM USB-HDD LAN **Disabled (Third)**	Standard legacy diskette drive Primary master IDE hard drive Standard SCSI drive Standard CDROM or DVD drive Primary slave IDE hard drive USB diskette drive USB ZIP drive USB CDROM drive USB harddisk drive Ethernet controller with LAN-Boot-ROM Disables boot device entry

Feature	Option	Description
PXE Lanboot	**Disabled** Enabled	Enables or disables the PXE Lanboot option
Boot Up Numlock Status	Off **On**	On or Off turns NumLock on or off at boot-up (keyboard feature)
Gate A20 Option	Normal **Fast**	Normal = a pin in the keyboard controller checks GateA20 Fast = lets chipset controls GateA20
Typematic Rate Setting	**Disabled** Enabled	Enables or disables manual adjustability
Typematic Rate	**6**, 8, 10, 12, 15,20, 24, 30 chars/sec.	Sets number of times to repeat a keystroke per second if you hold the key down
Typematic Delay	**250**, 500, 750, 1000 ms	Sets delay time after key is held down before it begins to repeat the keystroke
PS/2 Mouse Function	**Disabled** Enabled	Disabled prevents installed PS/2 mouse from functioning but frees IRQ12 Enabled forces the PS/2 mouse port to be enabled regardless if a mouse is present
Video BIOS Shadow	Disabled **Enabled**	Controls shadowing of Video BIOS area
C800 – CBFF Shadow	**Disabled** Enabled	Accesses to this upper memory region go to the ISA bus if Disabled or to local memory if Enabled
CC00 – CFFF Shadow	**Disabled** Enabled	See above
D000 – D3FF Shadow	**Disabled** Enabled	See above
D400 – D7FF Shadow	**Disabled** Enabled	See above
D800 – DBFF Shadow	**Disabled** Enabled	See above
DC00 – DFFF Shadow	**Disabled** Enabled	See above
Shadow Read/Write	**Disabled** Enabled	Normally shadow area only readable. Use this option to enable Write operation

24.6 Advanced Chipset Features

Feature	Option	Description
CPU Frequency	**Auto**, 200 MHz 333 MHz, 400 MHz 433 MHz, 500 MHz	Auto use the strap option config. (500 MHz) All others will be regard special hardware facts and performance requests
Memory Speed	DDR200, **DDR266**, DDR333	Selects memory speed if CPU frequency do not use the Auto setting
Mem Controller Buffering	Disabled **Enabled**	Improves the stability of DDR333 memory speed
Mem Controller Line Delay	0, 1, **2**, 3	Improves the stability of DDR333 memory speed
Video Memory Size	**8**, 16, 32, 64, 128, 254 MB	Defines Video memory size. Video memory shares system memory
Output Display	**CRT**, LCD LCD & CRT	Selects display boot devices. CRT & LCD is the simultaneous mode
Resolution	Auto, VGA, **SVGA** XGA, SXGA, UXGA	Select Auto whenever using a JILI cable. VGA, SVGA, XGA, SXGA and UXGA provides standard timings for LCD panel resolutions
Color Depth	**18 Bit** 24 Bit	Defines LCD color depth
Pixel per Clock	**Single** Dual	Defines LCD clock source
Color Mode	**FPDI** LDI	Only valid for 24 bit color depth. FPDI = Flat Panel Display Interface (Open)LDI = LVDS Display Interface
Backlight Value	0, 10, 20, 30, **40**, 50 60, 70, 80, 100, 120 150, 180, 210, 230, 250	Chooses a value to adjust backlight of the LCD 0 = 0 V 250 = nearly maximal voltage
Security Block	**Disabled** Enabled	Enables or disables the internal PCI Security Block
Network Controller	**Enabled** Disabled	Enables or disables the PCI Network Controller
USB Controller	**Enabled** Disabled	Enables or disables the internal PCI USB Controller
Watchdog Mode	**Disabled** Generate RESET	Enables or disables the watchdog mode
Watchdog Timeout	1s, 5s, 10s, **30s**, 1min, 5.5min, 10.5min, 30.5min	Selects maximum trigger period
Watchdog Delay	1s, 5s, 10s, **30s**, 1min, 5.5min, 10.5min, 30.5min	Selects time until the watchdog counter starts counting. Useful to handle longer boot times

24.7 Integrated Peripherals

Feature	Option	Description
Master/Slave Drive PIO Mode	**Auto** Mode 0 Mode 1 Mode 2 Mode 3 Mode 4	Selects HDD PIO mode or Auto for optimum transfer mode
IDE Primary Master/Slave UDMA	Disabled **Auto**	Disables UDMA or selects the optimum transfer mode
IDE Bus Master Mode	Disabled **Enabled**	Enables or disables IDE bus master mode
IDE HDD Block Mode	Disabled **Enabled**	Enables or disables IDE block mode
KBC input Clock	6, **8**, 12, 16 MHz	Selects the keyboard clock
Onboard FDC Controller	Disabled **Enabled**	Enables or disables onboard FDC controller
Onboard Serial Port 1/2	Disabled **3F8/IRQ4 (Port 1)** **2F8/IRQ3 (Port 2)** 3E8/IRQ4 2E8/IRQ3	Selects I/O base and IRQ of serial port respectively disables the port
Onboard Parallel Port	Disabled **378/IRQ7** 278/IRQ5 3BC/IRQ7	Selects I/O base and IRQ of serial port respectively disables the port
Parallel Port Mode	**Standard** EPP	Sets the mode for parallel port Standard = bidirectional EPP = Enhanced Parallel Port specification
EPP Mode Select	EPP1.9 **EPP1.7**	Selects the EPP specification

24.8 PnP/PCI Configurations

Feature	Option	Description
Init Display First	**Onboard** ISA Slot PCI Slot	Defines the primary Video controller. If no ISA Video adapter exists, no falling back to Onboard controller is realized
Reset Configuration Data	**Disabled** Enabled	Enabled erases all configuration data in Extended System Configuration Data (ESCD), which stores the configuration settings for plug-in devices
Resources Controlled by	**Auto(ESCD)** Manual	Selects Auto the system BIOS configure all PnP data Manual allows user configuration of PCI IRQs
First/Second PCI IRQ	IRQ3 IRQ4 IRQ5 IRQ7 **IRQ10 (First)** **IRQ11 (Second)** IRQ12 IRQ15	The system BIOS must have two PCI IRQs. PCI interrupts own the highest priority and disabling legacy (ISA) IRQs, also internal Serial and Parallel ports

24.9 PC Health Status

Feature	Option	Description
System Temp. (Local)	N/A	Temperature of onboard LM84 sensor (local temperature)
CPU Die Temp. (Remote)	N/A	Temperature of CPU Die (LM84 remote temperature)
Shutdown Temperature	**Disabled** 60^0C, 65^0C, 70^0C, 75^0C, 80^0C, 85^0C, 90^0C, 95^0C, 100^0C, 100^0C, 105^0C, 110^0C, 115^0C, 120^0C, 125^0C	Defines the shutdown temperature
Board Voltage +Vcore	N/A	Vcore voltage (generated onboard)
Board Voltage +3.3V	N/A	3.3V voltage (generated onboard)
System Voltage +5.0V	N/A	5.0V voltage (external power supply)
System Voltage +12.0V	N/A	12.0V voltage (external power supply)

24.10 Special BIOS Hints

24.10.1 Display Configuration

The setting 'PnP/PCI Configurations ⇨ Init Display First' is valid, regardless if there is a Video controller detected or not. In case a ISA slot is selected for example, there will be no fallback to the onboard controller, if no ISA VGA card is detected. So the memory range A0000h to BFFFFh may be used for a different purpose.

24.11 Kontron BIOS Extensions

Besides the Award System BIOS, the MOPSlcdLX comes with a few BIOS extensions that support special features. All extensions are located in the onboard Flash. Some extensions are permanently available; some are loaded if required during boot-up.

Supported features include:

- JIDA standard
- Remote Control feature (JRC)
- Onboard LAN PXE ROM

All enabled BIOS extensions require shadow RAM. However, if the system memory cannot find free memory space because all the memory is already used for add-on peripherals, the BIOS extensions do not load.

24.11.1 JIDA BIOS Extension

The JUMPtec Intelligent Device Architecture (JIDA) interface is integrated into the BIOS of the MOPSlcdLX module. This interface enables hardware-independent access to features that cannot be accessed via standard APIs. Functions such as watchdog timer, brightness of LCD backlight and user bytes in the EEPROM can be configured with ease by taking advantage of this standard MOPS PC/104 module feature.

The JIDA BIOS extension is not a true extension BIOS. It is part of the system BIOS and is located in the system BIOS segments after boot-up. It is permanently available and supports the JIDA 16-bit standard and the JIDA 32-bit standard.

The JIDA 16-bit standard is a software interrupt 15h driven interface for programmers and offers lots of board information functions. For detailed information about programming, refer to the JIDA specification and a source code example (JIDAI???.ZIP), which you can find on the Kontron Web site. The three question marks represent the revision number of the file. You also can contact technical support for this file.

For other operating systems, special drivers (JIDAIA??.ZIP) are available. You can download the zip file from the Kontron Web site.

24.11.2 Remote Control Client Extension

You can remotely control the MOPSlcdLX using software available from Kontron (JRC-1, Part Number 96047-0000-00-0). This software tool can communicate with the board via one of the serial ports. During boot-up, the system BIOS scans the serial ports for an available JRC connection. If detected, it loads the JRC client BIOS extension into the memory. The JRC client is always loaded into the memory location DE000h, a 16K block is shadowed.

For more information on the Remote Control usage, refer to the JRC-1 technical manual or Application Note JRCUsage_E???.PDF, which you can find on the Kontron Web site.

24.11.3 LAN PXE ROM

This optional ROM allows you to boot the MOPSlcdLX over an Ethernet connection. If the onboard LAN PXE ROM is enabled in the system BIOS Setup, an optional ROM for the Ethernet controller loads into memory during boot up. A server with Intel PXE boot support is required on the other side of the Ethernet connection. The setup and configuration of the server, including PXE support, is not the responsibility of Kontron.

The PXE ROM extension is loaded into the first free memory area between C8000h and DFFFFh, and a 48K block of memory is shadowed.

Appendix A: System Resourcen

A.1 Interrupt Request Lines

Please note that Kontron PC/104 devices were designed after the draft of P996 Specification for ISA systems. Because of this, shareable interrupts are not supported. Some PC/104 add-on board manufacturers do not follow the P996 Specification and allow shareable interrupts. If you want to use such PC/104 boards with Kontron devices, contact the manufacturer of the add-on board and ask about switching to non-interrupt sharing.

IRQ #	Use	Available	Comment
0	Timer0	No	
1	Keyboard	No	
2	Cascade	No	
3	COM2	No	*Note (1), Note (2)*
4	COM1	No	*Note (1), Note (2)*
5		Yes	*Note (3)*
6	FDC	No	*Note (1)*
7	LPT1	No	*Note (1), Note (3)*
8	RTC	No	
9	(ACPI)	No	*Note (4)*
10	First PCI IRQ	No	*Note (5)*
11	Second PCI IRQ	No	*Note (5)*
12	PS/2 Mouse	No	*Note (1)*
13	FPU	No	
14	IDE0	No	
15	(IDE1)	No	*Note (6)*

Note:
1. *If the „used for" device is disabled in setup, the corresponding interrupt is available for other devices.*
2. *Attention: BIOS settings determine which physical COM connector is assigned to a logical COM port.*
3. *LPT1 also can be configured for IRQ5.*
4. *Not available if ACPI is used.*
5. *Default values. Both PCI IRQs can be assigned to other interrupt lines.*
6. *Not usable in Windows, since a PCI IDE controller uses always two channels.*

A.2 Direct Memory Access (DMA) Channels

DMA #	Used for	Available	Comment
0		Yes	
1		Yes	
2	FDC	No	*Note (1)*
3		Yes	
4	Cascade	No	
5	----	No	*Note (2)*
6	----	No	*Note (2)*
7	----	No	*Note (2)*

Note: *1 If the „used for" - device is disabled in setup, the corresponding DMA is available for other devices.*
2 16 bit DMA channels not available.

A.3 I/O Address Map

The I/O-port addresses of the processor module MOPSlcdLX are functionally identical to a standard PC/AT. All addresses not mentioned in this table should be available. We recommend that you do not use I/O addresses below 0110h with additional hardware for compatibility reasons, even if available.

I/O Address (h)	Use	Available	Comment
0000 - 001F	DMA Controller 1	No	Fixed
0010	System Control	No	Fixed
0020 - 003F	Interrupt Controller 1	No	Fixed
0040 - 005F	Timer, Counter	No	Fixed
0060 - 006F	Keyboard controller	No	Fixed
0070	NMI Enable Register	No	Fixed
0070 - 0077	Real Time Clock and CMOS Registers	No	Fixed
0080	BIOS POST	No	Fixed
0081 - 008F	DMA Page Register	No	Fixed
0092	System Control	No	Fixed
00A0 00BF	Interrupt Controller 2	No	Fixed
00C0 - 00DF	DMA Controller 2	No	Fixed
00E0 - 00EF	System Control	No	Fixed
00F0 - 00FF	Math Coprocessor	No	Fixed
01F0 - 01F7	Fixed Disk	No	Fixed
0278 - 027F		Yes	Possible address of LPT2
02E8 - 02EF		Yes	Possible address of COM4
02F8 - 02FF	Serial Port 2	No	Default for COM2, free with different configuration
0378 - 037F	Parallel Port 1	No	Default for LPT1; free with different configuration
03BC - 03C4		Yes	Possible address of LPT3
03B0 - 03DF	VGA	No	Fixed
03E8 - 03EF		Yes	Possible address of COM3
03F0 - 03F7	Diskette Controller	No	Free, if device is disabled in setup
03F8 - 03FF	Serial Port 1	No	Default for COM1, free with different configuration
0480 - 048F	DMA Extension	No	Fixed
04D0 - 04D8	PIC Extension	No	Fixed
0A78 - 0A7F	PnP Extension	No	Fixed
0CF8 - 0CFF	PCI Configuration	No	Fixed
6000 - 63FF	Reserved	No	Fixed (Default address from AMD PCI ISA-Bridge)
9C00 - 9FFF	Reserved	No	Fixed (Default address from AMD PCI ISA-Bridge)
AC1C - AC1F	Reserved	No	Fixed (Default address from AMD PCI Host Bridge)
FE00 - FE0F	Reserved	No	Fixed (Default address from AMD PCI IDE Controller)
FF00 - FF3F	Reserved	No	Fixed (Default address from INTEL PCI Network Controller

A.4 Memory Map

The MOPSlcdLX processor module can support up to 1 GB memory modules. As the MOPSlcdLX uses Shared Memory Architecture (SMA) the amount of graphic memory reduces the available amount of system memory. The first 640 kB of DRAM are used as main memory.

Using DOS, you can address 1 MB of memory directly. Memory area above 1 MB (high memory, extended memory) is accessed under DOS via special drivers such as HIMEM.SYS and EMM386.EXE, which are part of the operating system. Please refer to the operating system documentation or special textbooks for information about HIMEM.SYS and EMM386.EXE.

Other operating systems (Linux or Windows versions) allow you to address the full memory area directly.

Upper Memory	Use	Available	Comment
A0000h – BFFFFh	VGA Memory	No	Mainly used by graphic adapter cards.
C0000h – CBFFFh	VGA BIOS	No (Yes)	The VGA-BIOS exceeds the standard area of C0000h - C7FFFh normally used by ISA VGA cards. Free if VGA-BIOS only use 32 kB (e.g. Onboard graphic).
CC000h – DFFFFh		Yes	Free for ISA bus or shadow RAM in standard configurations. If onboard LAN PXE ROM is enabled, or JRC is used, a block is shadowed for BIOS extensions, starting with first free area at CC000h or D0000h, D4000h, D8000hor DC000h. (BIOS extensions do not use the whole shadow block). JRC is always starting at DE000h.
E0000h – E7FFFh		Yes	Free for ISA bus.
E8000h – F0000h	System BIOS	No	

A.5 PCI Devices

All devices follow the Peripheral Component Interconnect 2.2 (PCI 2.2) specification. The BIOS and OS control memory and I/O resources. Please see the PCI 2.2 specification for details.

PCI Device (IDSEL)	PCI IRQ	REQ / GNT	Comment
Onboard Host Bridge	None		Integrated in chipset
Onboard Graphic Controller	INTA#	-	Integrated in chipset
Ethernet 82551ER (AD19)	INTC#	Discrete channel for Ethernet	
Onboard ISA Bridge	None		Integrated in chipset
Onboard IDE Controller	None		Integrated in chipset
Onboard USB Controller 1	INTD#	-	Integrated in chipset
Onboard USB Controller 2	INTD#	-	Integrated in chipset
Onboard Encryption Controller	INTA#	-	Integrated in chipset

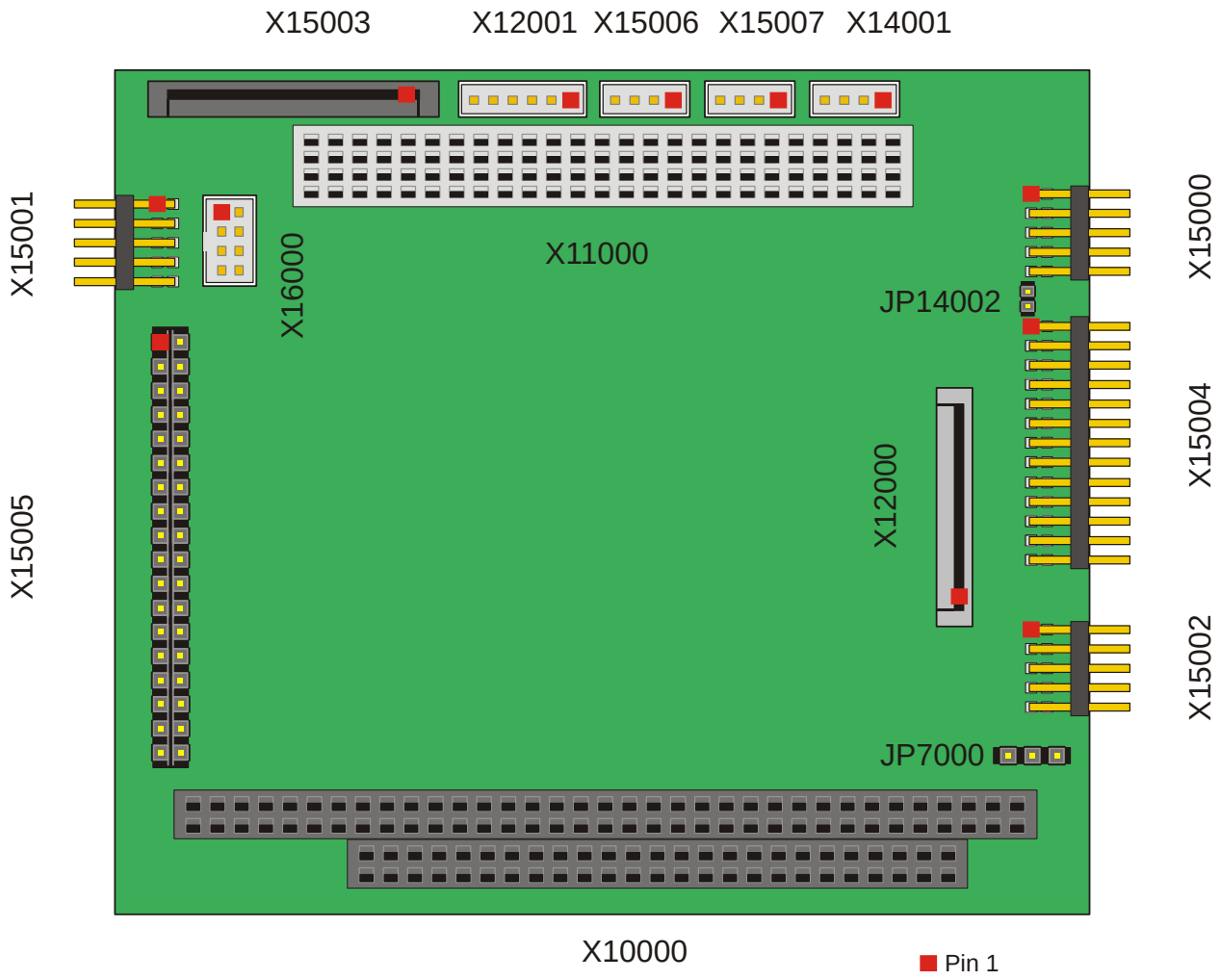
A.6 SMBus Devices

The MOPSlcdLX uses an onboard System Management (SM) Bus. This bus is not available on an peripheral connector and therefore cannot be used for external SMBus devices.

SMBus Address	SM Device	Comment
98h	Temp. Sensor (LM86)	Onboard temperature sensor.

Note: *There are more devices connected to the SMBus than listed in this table, but access to these devices in not permitted. Don't access any other device addresses except those listed above.*

Appendix B: Connector Layout



The Board as depicted is a model only, showing the positions of the connectors. For pincount and pinning please see the following tables.

B.1 Connector Functions & Interface Cables

The table notes connector functions, as well as mating connectors and available cables.

Connector	Function	Mating Connector	Available Cable	Description
J8000	SDRAM	-	-	-
X15004	LPT Connector	2.54mm 26 pos. (AMP 2-215882-6 or comp.)	KAB-DSUB25-1 (PN 96015-0000-00-0)	for DSUB-25 adaptation.
X14001	PS/2 Mouse Connector	1.25mm 4 pos. (Molex 51021-0400 or comp.)	KAB-MOUSE-PS2 (PN 96062-0000-00-0)	for PS/2 mouse.
X15006, X15007	USB interface Connectors	1.25mm 4 pos. (Molex 51021-0400 or comp.)	KAB-USB-1 (PN 96054-0000-00-0)	for standard USB adapt..
X15002	Keyboard and Feature Connector	2.54mm 10 pos. (AMP 1-215882-0 or compatible)	KAB-KB-1 (PN 96023-0000-00-0) or KAB-KB-PS2 (PN 96060-0000-00-0)	for AT-keyboard or PS/2 keyboard.
X15003	Floppy Drive Connector	Flat-Foil-Cable	ADA-FLOPPY-2 (PN 96001-0000-00-0) or KAB-FLOPPY/MOPS-1 (PN 96019-0000-00-0)	for 3.5" floppy or slim-line floppy.
X15005	IDE Hard Disk Connector	2mm 44 pos. (Berg 89361-144 or compatible)	KAB-IDE-25 (PN 96020-0000-00-0) or KAB-IDE-2MM (PN 96021-0000-00-0)	for 3.5" HDD or 2.5" HDD.
X16000	Ethernet Interface Connector	2mm 8 pos. (Berg 90311-008 or compatible)	KAB-MOPS-ETN1 (PN 96048-0000-00-0)	for RJ45 adaptation.
X12000	Flat-panel display Connector	Flat-Foil-Cable	KAB-JILI-?????	Kontron JILI cables.
X15000, X15001	Serial Interfaces COM A and COM B Connectors	2.54mm 10 pos. (AMP 1-215882-0 or compatible)	KAB-DSUB9-2 (PN 96017-0000-00-0)	for DSUB-9 adaptation.
X10000a	PC/104 Bus (XT-bus part)	2.54mm 64 pos. (EPT 962-60323-12 or compatible for board to board connection)		
X10000b	PC/104 Bus (AT-bus part)	2.54mm 40 pos. (EPT 962-60203-12 or compatible for board to board connection)		
X10000c	Power Connector	2.54mm 8 pos. (EPT 962-60043-12 or compatible for board to board connection)		
X12001	CRT Monitor Connector	1.25mm 6 pos. (Molex 51021-0600 or comp.)	KAB-VGA-2 (PN 96053-0000-00-0)	for DSUB-15 adaptation.

B.2 Pinout Table

	PC104 Bus (A) X10000a	PC104 Bus (B) X10000b	PC104 Bus (C) X10000b	PC104 Bus (D) X10000b	PC/104 Plus (A)	PC/104 Plus (B)	PC/104 Plus (C)	PC/104 Plus (D)
0			GND	GND				
1	/IOCHCK	GND	/SBHE	/MEMCS16	Reserved	Reserved	NC	AD00
2	SD7	RESETDRV	LA23	/IOCS16	VCC3 *(3)*	AD02	AD01	NC
3	SD6	VCC *(3)*	LA22	IRQ10	AD05	GND	AD04	AD03
4	SD5	IRQ9	LA21	IRQ11	C/BE0	AD07	GND	AD06
5	SD4	-5V	LA20	IRQ12	[illegible]	AD09	AD08	GND
6	SD3	DRQ2	LA19	IRQ15	AD11	VCC3	AD10	M66EN
7	SD2	-12V	LA18	IRQ14	AD14	AD13	GND	AD12
8	SD1	/0WS	LA17	/DACK0	VCC3	C/BE1	AD15	VCC3 *(3)*
9	SD0	+12V	/MEMR	DRQ0	SERR *(2)*	GND	Reserved	PAR
10	IOCHRDY	GND *(1)*	/MEMW	/DACK5	GND	PERR *(2)*	VCC3 *(3)*	Reserved
11	AEN	/SMEMW	SD8	DRQ5	STOP	VCC3 *(3)*	LOCK *(2)*	GND
12	SA19	/SMEMR	SD9	/DACK6	VCC3 *(3)*	TRDY	GND	DEVSEL
13	SA18	/IOW	SD10	DRQ6	FRAME	GND	IRDY	VCC3 *(3)*
14	SA17	/IOR	SD11	/DACK7	GND	AD16	VCC3 *(3)*	C/BE2
15	SA16	/DACK3	SD12	DRQ7	AD18	VCC3 *(3)*	AD17	GND
16	SA15	DRQ3	SD13	VCC *(3)*	AD21	AD20	GND	AD19
17	SA14	/DACK1	SD14	/MASTER	VCC3 *(3)*	AD23	AD22	VCC3 *(3)*
18	SA13	DRQ1	SD15	GND	IS0 (AD20)	GND	IS1 (AD21)	IS2 (AD22)
19	SA12	/REFRESH	GND	GND	AD24	C/BE3	VI/O	IS3 (AD24)
20	SA11	SYSCLK			GND	AD26	AD25	GND
21	SA10	IRQ7			AD29	NC	AD28	AD27
22	SA9	IRQ6			VCC	AD30	GND	AD31
23	SA8	IRQ5			REQ0	GND	REQ1	VI/O
24	SA7	IRQ4			GND	REQ2	NC	GNT0
25	SA6	IRQ3			GNT1	VI/O	GNT2	GND
26	SA5	/DACK2			NC	CLK0	GND	CLK1
27	SA4	T/C			CLK2	NC	CLK3	GND
28	SA3	BALE			GND	INTD	NC	RST
29	SA2	VCC *(3)*			+12V	INTA	INTB	INTC
30	SA1	OSC			-12V	Reserved	Reserved	Reserved
31	SA0	GND						
32	GND	GND						

Pin	IDE X15005	Floppy X15003	LPT X15004	Power X10000C	COM A X15000	COM B X15001
1	/RESET	VCC *(3)*	/STB	GND	/DCD1	/DCD2
2	GND	/IDX	/AFD	VCC *(3)*	/DSR1	/DSR2
3	HDD7	VCC *(3)*	PD0	BATT	RXD1	RXD2
4	HDD8	/DR0	/ERR	+12V	/RTS1	/RTS2
5	HDD6	VCC *(3)*	PD1	-5V	TXD1	TXD2
6	HDD9	/DSKCHG	/INIT	-12V	/CTS1	/CTS2
7	HDD5	VCC *(3)*	PD2	GND	/DTR1	/DTR2
8	HDD10	NC	/SLIN	VCC *(3)*	/RI1	/RI2
9	HDD4	NC	PD3		GND	GND
10	HDD11	/MTR0	GND		VCC *(3)*	VCC *(3)*
11	HDD3	NC	PD4			
12	HDD12	/FDIR	GND			
13	HDD2	NC	PD5			
14	HDD13	/STEP	GND			
15	HDD1	GND	PD6			
16	HDD14	/WDATA	GND			
17	HDD0	GND	PD7			
18	HDD15	/WGATE	GND			
19	GND	GND	/ACK			
20	KEY (NC)	/TRK0	GND			
21	DRQ	GND	BUSY			
22	GND	/WRTPRT	GND			
23	/IOW	GND	PE			
24	GND	/RDATA	GND			
25	/IOR	GND	SLCT			
26	GND	/HDSEL	VCC *(3)*			
27	IOCHRDY					
28	CSEL					
29	/AKJ					
30	GND					
31	SIRQ					
32	NC					
33	SA1					
34	NC					
35	SA0					
36	SA2					
37	/CS1					
38	/CS3					
39	NC					
40	GND					
41	VCC *(3)*					
42	VCC *(3)*					
43	GND					
44	NC					

Pin	KBD X15002	LAN X16000	CRT X12001	PS/2 Mouse X14001	USB 1 X15006	USB 2 X15007
1	SPEAKER	TXD+	RED	MSDAT	VCC *(3)*	VCC *(3)*
2	GND	TXD-	GRN	VCC *(3)*	USB00	USB10
3	/RESIN	RXD+	BLU	GND	USB01	USB11
4	/KBLOCK	SHLDGND	GND	MSCLK	GND	GND
5	KBDAT	SHLDGND	VSYNC			
6	KBCLK	RXD-	HSYNC			
7	GND	SHLDGND				
8	VCC *(3)*	SHLDGND				
9	BATT					
10	PWRGOOD					

Note: *1 Key pin for PC/104; GND for PC/104+ specification.*
2 Not supported on MOPSlcdLX boards.
3 To protect the external power lines of peripheral devices, make sure that
- *the wires have the right diameter to withstand the maximum available current.*
- *the enclosure of the peripheral device fulfils the fire protecting conditions of IEC/EN 60950.*

Appendix C: Literature Hints

The following sources of information can help you better understand PC architecture.

C.1 General PC Architecture

- *Embedded PCs*, Markt&Technik GmbH, ISBN 3-8272-5314-4 (German)
- *Hardware Bible*, Winn L. Rosch, SAMS, 1997, 0-672-30954-8
- *Interfacing to the IBM Personal Computer*, Second Edition, Lewis C. Eggebrecht, SAMS, 1990, ISBN 0-672-22722-3
- *The Indispensable PC Hardware Book*, Hans-Peter Messmer, Addison-Wesley, 1994, ISBN 0-201-62424-9
- *The PC Handbook: For Engineers, Programmers, and Other Serious PC Users*, John P. Choisser and John O. Foster, Annabooks, 1997, ISBN 0-929392-36-1

C.2 Buses

C.2.1 ISA, Standard PS/2 - Connectors

- AT Bus Design: Eight and Sixteen-Bit ISA, E-ISA and EISA Design, Edward Solari, Annabooks, 1990, ISBN 0-929392-08-6
- AT IBM Technical Reference Vol 1&2, 1985
- *ISA & EISA Theory and Operation*, Edward Solari, Annabooks, 1992, ISBN 0929392159
- ISA Bus Specifications and Application Notes, Jan. 30, 1990, Intel
- *ISA System Architecture, Third Edition,* Tom Shanley and Don Anderson, Addison-Wesley Publishing Company, 1995, ISBN 0-201-40996-8
- *Personal Computer Bus Standard P996*, Draft D2.00, Jan. 18, 1990, IEEE Inc.
- Technical Reference Guide, Extended Industry Standard Architecture Expansion Bus, Compaq 1989

C.2.2 PCI/PC-104

- *Embedded PC 104 Consortium*. The consortium provides information about PC/104 and PC/104-Plus technology. You can search for information about the consortium on the Web
- *PCI SIG*. The PCI SIG provides a forum for its ~900 member companies, who develop PCI products based on the specifications that are created by the PCI SIG. You can search for information about the SIG on the Web
- *PCI & PCI-X Hardware and Software Architecture & Design*, Fifth Edition, Edward Solari and George Willse, Annabooks, 2001, ISBN 0-929392-63-9
- *PCI System Architecture,* Tom Shanley and Don Anderson, Addison-Wesley, 2000, ISBN 0-201-30974-2

C.3 Ports

C.3.1 RS-232 Serial

- *EIA-232-E standard*. The EIA-232-E standard specifies the interface between (for example) a modem and a computer so that they can exchange data. The computer can then send data to the modem, which then sends the data over a telephone line. The data that the modem receives from the telephone line can then be sent to the computer. You can search for information about the standard on the Web
- RS-232 Made Easy: Connecting Computers, Printers, Terminals, and Modems, Martin D. Seyer, Prentice Hall, 1991, ISBN 0-13-749854-3
- *National Semiconductor*. The Interface Data Book includes application notes. Type “232” as a search criteria to obtain a list of application notes. You can search for information about the data book on National Semiconductor’s Web site

C.3.2 ATA

- *AT Attachment (ATA) Working Group*. This X3T10 standard defines an integrated bus inter- face between disk drives and host processors. It provides a common point of attachment for systems manufacturers and the system. You can search for information about the working group on the Web. We recommend you also search the Web for information on *4.2 I/O cable*, if you use hard disks in a DMA3 or PIO4 mode.

C.3.3 USB

- *USB Specification*. USB Implementers Forum, Inc. is a non-profit corporation founded by the group of companies that developed the Universal Serial Bus specification. The USB-IF was formed to provide a support organization and forum for the advancement and adop- tion of Universal Serial Bus technology. You can search for information about the standard on the Web

C.4 Programming

- *C Programmer's Guide to Serial Communications*, Second Edition, Joe Campbell, SAMS, 1987, ISBN 0-672-22584-0
- *Programmer's Guide to the EGA, VGA, and Super VGA Cards*, Third Edition, Richard Ferraro, Addison-Wesley, 1990, ISBN 0-201-57025-4
- *The Programmer's PC Sourcebook,* Second Edition, Thom Hogan, Microsoft Press, 1991, ISBN 1-55615-321-X
- *Undocumented PC, A Programmer's Guide to I/O, CPUs, and Fixed Memory Areas*, Frank van Gilluwe, Second Edition, Addison-Wesley, 1997, ISBN 0-201-47950-8

APPENDIX D: REVISION HISTORY

Revision	Date	Edited by#	Changes
1.0	05/16/2006	S. Laudan	First revision
1.1	07/07/2006	S. Laudan M. Hüttmann	Basic reworking
1.2	07/12/2006	M. Hüttmann	Minor changes
1.3	07/25/2006	M. Hüttmann	Added chapter Watchdog Timer and Onboard Device Configuration
1.4	08/17/2006	M. Hüttmann	Added some chapters (e.g. CPU, Chipset and Super I/O / Modification of panel parameters / Memory speed)
1.5	09/04/2006	M. Hüttmann	Change font, added chapter Memory Issues
1.6	11/07/2006	M. Hüttmann	Added chapter Kontron BIOS Extension and some Setup entries
1.7	12/07/2006	M. Hüttmann	Change chapter Special BIOS Hints
1.8	01/03/2007	M. Hüttmann	Delete restriction of PCI-clock-signals (PC104+ connector)
1.9	01/08/2007	M. Hüttmann	New Kontron Design
2.0	05/04/2007	M. Hüttmann	Added chapter Color Mode and Crisis Management. Added new Bios features from R109. Change Design
2.1	07/20/2007	M. Hüttmann	Added some memory (DDR-SDRAM) remarks and other minor changes